PATENT SPECIFICATION

DRAWINGS ATTACHED

Inventor: MICHAEL EDWARD ASH

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Application Date July 3, 1959. *No. 22932/59.*

(Patent of Addition to No. 876,629 dated Jan. 2, 1959).

Complete Specification Published March 4, 1964.

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COMPLETE SPECIFICATION

Improvements in a Method of and Apparatus for Dispensing Liquids Containing Gases in Solution

We, ARTHUR GUINNESS SON AND CO[illegible]

ERRATA

SPECIFICATION No. 951,434

Page 1, lines 1 and 2, *for* "Compiny" *read* "Company"
Page 1, line 18, *for* "been" *read* "become"
Page 1, line 40, *for* "bubles" *read* "bubbles"
Page 1, lines 42 and 43, *for* "contuity" *read* "continuity"
Page 1, line 67, *for* "construction" *read* "constriction"
Page 2, line 87, *for* "second" *read* "secondary"
Page 3, line 47, *for* "9" *read* "0"
Page 3, line 87, *for* "downsteam" *read* "downstream"

THE PATENT OFFICE
20th May 1964

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from a pressurised vessel, whereby a fine and enduring head of controlled size superior to heads hitherto obtainable may be produced.

Among the qualities normally sought in a head on beverages such as beer, ale and stout, may be listed the following:—

Regularity, by which is meant a consistent bubble size.

Fineness, by which is meant a small bubble size, e.g. bubles up to about 0.010 inches average diameter.

Homogeneity, by which is meant a con-

[illegible] a sudden drop in pressure; the maximum distance across any part of the constriction normal to the flow of liquor being such as to produce a fine bubble size in the liquor and the aggregate cross-sectional area of the constriction being such as to permit reasonable throughflow for dispensing purposes, and there being when the tap is open no constriction in the delivery passage downstream of the primary constriction which is of less aggregate area than the aggregate area of the apertures in the primary constriction, the combination being such that upon the tap being opened and

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COMPLETE SPECIFICATION

Improvements in a Method of and Apparatus for Dispensing Liquids Containing Gases in Solution

We, ARTHUR GUINNESS SON AND COMPINY (PARK ROYAL) LIMITED, of Park Royal Brewery, Cumberland Avenue, London, N.W.10, a British Company, do hereby declare the invention for which we pray that a Patent may be granted to us, and the method by which it is to be performed to be particularly described in and by the following statement:—

This invention relates to the dispensing of liquids, and is primarily concerned with improved means for dispensing beverages containing gas in solution, particularly fermented liquors, such as beer, stout and ales, from a pressurised system. It is an improvement in or modification of the invention of our co-pending Application No. 22757/59, (876,629).

It has been customary to employ pressurised casks for serving draught beer using carbon dioxide as pressure medium to avoid the problem of acetification which will arise if air is used as the pressure medium. This method of dispensing is effective, but the head obtainable on the dispensed liquor is not of a finely divided and enduring character.

The present invention has for its object to provide improved means for dispensing beverages, of the kind referred to, particularly fermented beverages such as beer, stout and ales, from a pressurised vessel, whereby a fine and enduring head of controlled size superior to heads hitherto obtainable may be produced.

Among the qualities normally sought in a head on beverages such as beer, ale and stout, may be listed the following:—

Regularity, by which is meant a consistent bubble size.

Fineness, by which is meant a small bubble size, e.g. bubles up to about 0.010 inches average diameter.

Homogeneity, by which is meant a continuity of bubble structure without the occurrence of large, irregularly shaped random gaps.

Endurance, by which is meant the ability of the bubble structure, when it has risen to the surface of the liquor after dispensing into a drinking vessel to persist during the process of drinking and regardless of whether or not the liquor is quaffed rapidly or sipped slowly.

By the expression "size of head" is meant the volume of froth initially present on the top of the liquor in any given drinking vessel after the beverage has been dispensed and the majority of the bubbles in suspension have had time to settle out from the liquor.

In our co-pending Application No. 22757/59 (876,629) there is provided means for dispensing at a substantially constant pressure, beverages which contain gas in solution comprising in combination a pressurised container; means for feeding the liquor from the container through a delivery passage to an outlet; a two-position on/off tap for starting and stopping flow through said delivery passage, and a primary construction located in the delivery passage and constituted by one or more apertures of fixed size in use; the length of the constriction in the direction of flow of the liquor being so short as to produce a sudden drop in pressure; the maximum distance across any part of the constriction normal to the flow of liquor being such as to produce a fine bubble size in the liquor and the aggregate cross-sectional area of the constriction being such as to permit reasonable throughflow for dispensing purposes, and there being when the tap is open no constriction in the delivery passage downstream of the primary constriction which is of less aggregate area than the aggregate area of the apertures in the primary constriction, the combination being such that upon the tap being opened and

flow taking place through the primary constriction, the pressure on the liquor downstream of the primary constriction is immediately reduced and the liquor thereafter proceeds down the delivery passage to the outlet at substantially atmospheric pressure, the sudden pressure drop occasioned by the passage through the plate releasing gas in solution from the liquor, so that a homogeneous, fine and regular head is formed when the liquor is dispensed into a vessel.

By the term "constriction" in this Specification and the appended claims, is meant a reduction in the cross-sectional area of the delivery passage relative to the normal cross-section of the pipe work.

The primary constriction advantageously comprises a perforated disc having a number of apertures of fixed size—conveniently, round holes—the disc being removably mounted in the delivery passage so that discs having an appropriate aperture size and giving an appropriate flow rate may be selected and used according to variations in gas pressure, temperature and other dispensing conditions.

The size of the said aperture is limited so as to produce a fine head on the dispensed liquor. For example, the apertures should in general be less than 0.08 inches in diameter, and preferably within the range 0.015 to 0.08 inches in diameter.

Since the function of the primary constriction is to produce a rapid drop in applied pressure on the liquor as it passes through the apertures, and thus to release gas in the form of bubbles, it will be understood that the thickness of the primary constriction in the direction of flow of the liquor must be small, for example in the order of 0.015 inches.

In our co-pending Application number 2314/58 (Serial No. 876628) it is proposed to use a mixture of carbon dioxide and an inert gas such as nitrogen, as the gases in solution for draught beer as it is found that this contributes towards regularity, homogeneity and endurance of the head on the dispensed liquor.

The primary constriction may be located downstream or upstream of the valve member of the tap.

The use of a primary constriction as above defined has been found to produce a very fine and regular head of improved character and quality, this being particularly the case when the applied propellant pressure is balanced by a mixture of carbon dioxide and an inert gas, such as nitrogen, substantially free from oxygen dissolved in the liquid, which materially aids the regularity, homogeneity and endurance of the head.

According to the present invention, a secondary constriction is disposed downstream of the primary constriction, the secondary constriction having a tapered bore which is decreased in cross-sectional area in the direction of flow of the liquor, the internal length of said tapered bore being at least twice the mean diameter of the inlet diameter of the secondary constriction, the smallest cross-sectional area of the tapered bore being not less than the aggregate cross-sectional area of the apertures in the primary constriction; whereby the size of head produced when the liquor is dispensed into a vessel may be determined by varying the relationship between the minimum cross-sectional area of the secondary constriction in relation to the aggregate cross-sectional area of the apertures in the primary constriction.

In this specification and appended claims the term "liquid delivery passage" shall mean the pipework extending from the pressurised cask to and through the dispensing tap, and shall include the liquid flow passages in the inlet portion, body portion and, outlet portion of the combined body structure.

The primary and second constrictions may conveniently be removable members embodied in a tap structure adapted to be connected to the pressurised vessel.

Since individual beverages may vary in behaviour and since variations in operating pressure may be desired according to local conditions and temperatures, it will be appreciated that the provision of detachable perforated discs constituting the primary constriction enables rapid adjustment of bubble size and flow rate to be performed.

Similarly, the secondary constriction has been found to exert a control on head size, and the ability to substitute differing sizes of tapered nozzle enables a substantially constant head size to be produced under widely varying draughting conditions. An example of a tapered nozzle secondary constriction suitable for use in a tap structure constructed according to this invention comprises a cylindrical body member of $1\frac{1}{2}$ inches overall length, and 9/16 inch external diameter, one end of which cylinder has a 21/32 inch diameter flange of 1/32 inch thickness; a liquid flow passage through the cylinder is formed by a $\frac{1}{2}$ inch diameter hole bored along the axis of the cylinder from the flange end for a depth of $\frac{1}{2}$ inch, the remainder of the flow passage being of a tapered form and converges from the $\frac{1}{2}$ inch diameter bore to a 3/16 inch diameter liquid outlet hole at the opposite end of the cylinder to the flange.

The invention is hereafter described by way of example with reference to the diagrammatic drawings filed with the Provisional Specification comprising . . . . Figs. 1 to 3 and the accompanying drawing filed herewith comprising Fig. 4, in which Fig. 1 is a vertical section illustrating a tap structure provided with a primary and secondary constriction.

Fig. 2 is a perspective view of the primary constriction shown in Fig. 1.

Fig. 3 is a cross sectional perspective view of the secondary constriction shown in Fig. 1 and,

Fig. 4 is a vertical section illustrating a tap structure provided with a primary constriction only.

It is first convenient to describe a typical structure in accordance with our co-pending Application No. 22757/59 (876,629) which is illustrated in Figs. 2 and 4. The invention of Application 22757/59 (876,629) includes a primary constriction which may be embodied in a two-position tap structure of conventional form. As shown, the tap structure may comprise a body portion 1 having an inlet portion 2 and an outlet portion 3, the gate or valve member of the tap being formed by a resilient member 4 carried by a cam-operated spindle 5 mounted in the body of the tap and loaded in the closing direction by a compression spring 6. The resilient member 4 seats on an annular seating 7 in conventional manner and is operable by a handle 8 pivoted to an extension of the spindle 5 at 10 and having a cam portion 9 which, when the handle 8 is moved from the horizontal position shown towards a vertical position, lifts the spindle 5 and consequently moves the valve member 4 away from the seating 7 against the compression of the spring 6 to permit flow of liquor through a liquid delivery passage extending from a pressurised vessel to which the tap structure is connected, and the downward extremity of the outlet portion 3, said liquid delivery passage including liquid flow passages in the inlet portion 2, body portion 1, and outlet portion 3 of the tap structure.

The primary constriction comprises a detachable flanged perforated plate 11 including a sleeve portion 11*a*, a flange 11*b* and a thin perforated disc portion 11*c*. The apertures 11*d* in the disc 11*c* must be of limited size not exceeding a certain critical diameter which is a function of the delivery temperature. In the case of beer, it has been found that at 60°F, this critical diameter is of the order of 9.08 inches, but at lower temperatures it is certainly smaller. As long as the apertures are smaller than the critical size, the size of the head is substantially unaffected by the size or number of apertures. It has been found that apertures of about 0.02 inches in diameter are suitable for normal conditions of serving. The thickness of the disc portion 11*c* preferably should not exceed 0.015 inches so as to ensure a very rapid drop in pressure for releasing gas in solution in the form of bubbles as the liquor passes through the apertures. The aggregate area of the apertures 11*d* determines the rate of delivery of liquor when the valve member 4 is in the open position. For example, at a dispensing pressure of 20 lbs per square inch (gauge) and six holes of 0.04 inches diameter a ten ounce glass may be filled in approximately 5 seconds, which represents a flow rate of approximately 60 cubic centimetres per second.

When the primary constriction is located upstream of the valve member 4 of the tap, as shown, the cross-sectional area of the passage through the tap when the valve member is open should be greater than the aggregate cross-sectional area of the apertures 11*d* in the primary constriction, and no part of the delivery passage downstream of the primary constriction should be of lesser cross-sectional area than said aggregate cross-sectional area of the apertures 11*d*. Conveniently, the primary constriction 11 may be mounted in a sleeve 11*e* inserted in a bore in the inlet portion 2 of the tap structure.

In a modification, the primary constriction may be located downstream of the valve member 4 of the tap, i.e. in the part of the delivery passage extending in the outlet portion 3 of the tap structure, in which case no part of the delivery passage downsteam of the primary constriction is of lesser area than the aggregate cross-sectional area of the apertures 11*d*. The shape and size of the part of the tap structure downstream of the primary constriction must be such that the liquor can escape from the outlet portion 3 at least as fast as it can pass through the apertures 11*d*, and so that the jets of liquor emerging from the apertures 11*d* are collected together before delivery from said outlet.

The pressurised vessel may be a metal cask equipped with a cylinder containing a gas, such as carbon dioxide or a mixture of gases, such as carbon dioxide with an inert gas, such as nitrogen, and having a reducing valve and a bush to which the inlet portion 2 of the tap structure is connected, either directly or through a suitable conduit. Preferably, the gas cylinder and reducing valve are housed within the cask. Alternatively, a plurality of pressurised vessels may be supplied with gas or mixed gases from a single cylinder or battery of cylinders.

In cases where it is desired to control the size of head within predetermined limits, the secondary constriction 12 of this invention is used as shown in the embodiment illustrated in Figs. 1 and 3. The secondary constriction is located downstream of the primary constriction 11. The secondary constriction 12 is in the form of a sleeve replacing the sleeve 11*e* in the embodiment of Fig. 1, and has a tapered bore converging to a constricted outlet 12*c*, the internal length of the tapered bore being at least twice the mean diameter of the inlet diameter of the secondary constriction. The inlet end of the secondary constriction 12 has an enlarged bore 12*b* to receive the primary constriction 11, and a flange 12*a* abutting against the inlet end of the inlet portion 2 of the tap structure. The cross-sectional area of the outlet 12*c* is at least equal to the aggregate area of the apertures 11*d*. The

greatest head size is obtained when the secondary constriction exerts no appreciable throttling of the flow through the delivery passage after the liquor has passed through the apertures 11*d*. On the other hand, the minimum head size will be produced when the cross-sectional area of the outlet 12*c* is equal to, or only fractionally larger than, the aggregate cross-sectional area of the apertures 11*d*. Between these upper and lower limits, suitable variations can be obtained in the size of head by varying the size of the outlet 12*c* of the secondary constriction 12. This is an advantageous feature as it permits variation in head size under constant conditions of serving or, conversely, can be used to produce a substantially constant head when conditions of serving vary, particularly as regards the ambient temperature. The cross-sectional area of the secondary constriction or of any part of the delivery passage downstream of the primary constriction must never be less than the aggregate cross-sectional area of the apertures 11*d*, otherwise build-up of pressure will occur between the primary constriction 11 and the secondary constriction 12, which would detrimentally affect control of the quality and size of head.

It will be understood that by utilising interchangeable primary constrictions 11 with apertures of selected diameter within the range indicated, and interchangeable secondary constrictions of selected cross-sectional area in relation to the aggregate cross-sectional area of the apertures in the primary constriction, the character and size of head can be closely controlled for any given temperature of serving, the rate of delivery also being controllable by varying the number of perforations in the primary constriction 11.

Furthermore, it will be understood that the invention is not limited to the particular embodiments hereinbefore described. For example, the primary and secondary constrictions although preferably embodied in the tap structure, may be located at any position in the delivery passage intermediate the pressurised vessel and the tap structure. Alternatively, these constrictions may be located in a detachable outlet nozzle portion of the tap structure.

The primary constriction itself can be of varying form, for example it can be a flat plate-like member, a hemispherical member or a conical or frusto-conical member, provided always that its wall thickness is such as to provide the desired rapid pressure drop.

WHAT WE CLAIM IS:—

1. The improvement in or modification of the means for dispensing beverages claimed in our co-pending Patent Application No. 22757/59 (876,629) wherein a secondary constriction is provided and is disposed downstream of the primary constriction, the secondary constriction having a tapered bore which is decreased in cross-sectional area in the direction of flow of the liquor, the internal length of said tapered bore being at least twice the mean diameter of the inlet diameter of the secondary constriction, the smallest cross-sectional area of the tapered bore being not less than the aggregate cross-sectional area of the apertures in the primary constriction; whereby the size of head produced when the liquor is dispensed into a vessel may be determined by varying the relationship between the minimum cross-sectional area of the secondary constriction in relation to the aggregate cross-sectional area of the apertures in the primary constriction.

2. Means according to claim 1, wherein the secondary constriction is removably mounted in the delivery passage to facilitate adjustment of the relationship between the primary and secondary constrictions.

3. Means according to claim 1 or 2, wherein the secondary constriction forms part of the tap structure.

4. Means according to claim 3, wherein the primary constriction is mounted adjacent to or within the inlet end of the secondary constriction and the assemblage comprising the primary and secondary constrictions is detachable located in a passage of the tap structure.

5. Means for dispensing beverages incorporating primary and secondary constrictions arranged, constructed and adapted to operate substantially as herein described.

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951434 PROVISIONAL SPECIFICATION

1 SHEET *This drawing is a reproduction f the Original on a reduced scale*

Fig. 1.

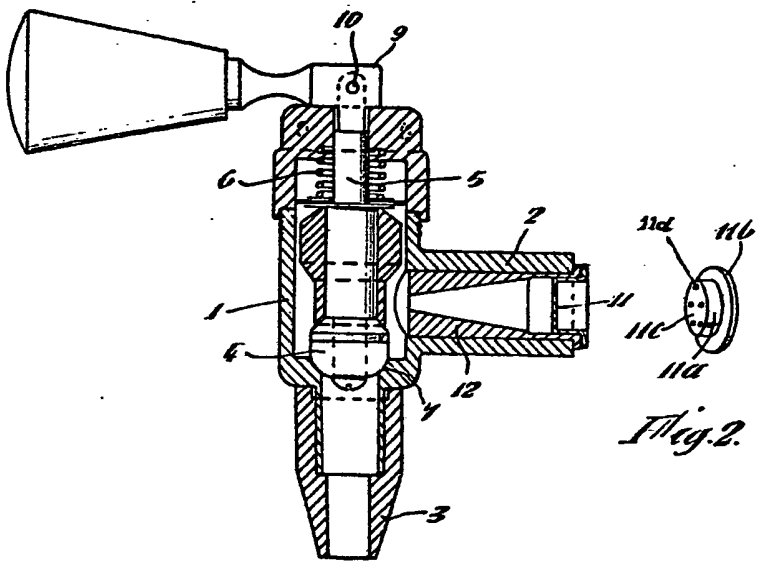

Fig. 2.

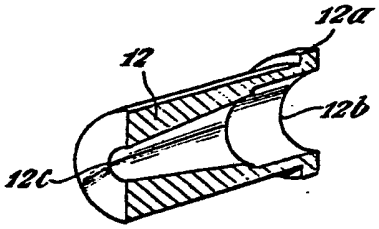

Fig. 3.

951434 COMPLETE SPECIFICATION

1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

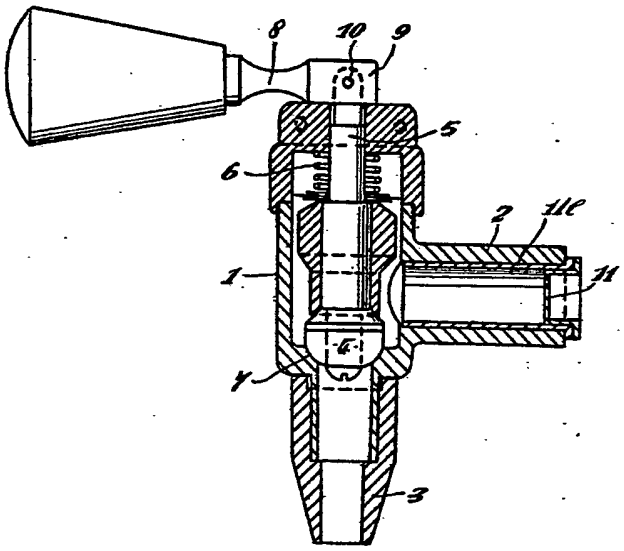

Fig. 4.